Econometrics 2 for Economics and Finance – Seminar 4b

Problem 4: Predictors of bank distress. Suppose that you are an economist working for the Banque de France (BdF, Bank of France). Your boss asks you to write a report identifying the key predictors of bank distress.[1]

In your data you have the following variables:

- Bank distress
- Banks' funding structure
  - Liquid Liabilities Ratio: (Postal Notes and Demand Deposits)/Demand Liabilities (Total Liabilities - Equity)
  - Foreign Funding Ratio: Foreign Funding/Demand Liabilities (Total Liabilities - Equity)
  - Leverage: Total Assets/Equity
  - Leverage Growth: Growth Rate of Leverage
- Banks' assets and fundamentals
  - Share Lending Ratio: Lending against Equities/Total Assets
  - Cash/Total Assets: (BdF Notes + Gold + Gold Coins)/Total Assets
  - ROE: Return on Equity
- Banks' institutional characteristics
  - Age: Log(Age) in Months, Counted from the Incorporation Date
  - Board Members: Number of Board Members
  - Liability Structure: Dummy Variable Taking Value 1 if a Bank was an unlimited liability bank

[1] A bank is defined as being in distress if it receives a capital injection by the state or participates in asset relief programmes.

Your assistant has produced the following results. You must provide your boss with your report.

Task: Write your report based on the file. To do so, you will need to answer the following questions (specify which Figure(s) to examine):

1. What is the percentage and number of distressed banks?
2. Comment the descriptive statistics.
3. Why is no figure showing average marginal effects for the linear probability model?
4. Why are you estimating a logit and probit model and not only a linear regression model?
5. Based on the results, why would you prefer the logit and probit models over the linear probability model?
6. If you have to choose between the logit and probit models based on the fitted log-likelihood value, which model would you use?
7. Why does the logit model produce an average in-sample predicted probability equal to the sample frequency?
8. Which variables have a significant (at the 5% significance level) explanatory power in the logit and probit models?
9. Compare the estimation results across the logit and probit models.

The file: pages 3 to 6.

Variable	Obs	Mean	Std. dev.	Min	Max
liquid_lia~o	1,000	.4925308	.2894846	.0009672	.9978225
foreign_fu~o	1,000	.4941764	.2860246	.0012645	.9985868
leverage	1,000	5.003343	2.850114	.0075825	9.996477
leverage_g~h	1,000	-.0162441	2.871289	-4.992469	4.99097
share_lend~o	1,000	.501881	.2950543	.0004328	.9987934
cash_total~s	1,000	.5026981	.2870674	.0002998	.9958224
roe	1,000	.0277883	.5668066	-.997667	.9990869
age	1,000	246.3211	143.7815	1.430273	499.0783
board_memb~s	1,000	4.86	2.259537	0	14
liability_~e	1,000	.214	.410332	0	1
distress	1,000	.264	.4410198	0	1

Figure 1: Descriptive statistics, all banks

Variable	Obs	Mean	Std. dev.	Min	Max
liquid_lia~o	264	.6499419	.2547085	.0215773	.9975871
foreign_fu~o	264	.5077005	.2818667	.0012982	.9984214
leverage	264	4.967297	2.877874	.0606574	9.996477
leverage_g~h	264	.3243462	2.846093	-4.984247	4.970077
share_lend~o	264	.6583779	.263308	.0253384	.9987934
cash_total~s	264	.5063282	.2912768	.0002998	.9953552
roe	264	-.3197113	.4918597	-.997667	.9769852
age	264	251.6068	140.6324	1.430273	496.4073
board_memb~s	264	4.890152	2.23676	0	14
liability_~e	264	.4318182	.4962702	0	1

Figure 2: Descriptive statistics, distressed banks

Variable	Obs	Mean	Std. dev.	Min	Max
liquid_lia~o	736	.4360682	.2803476	.0009672	.9978225
foreign_fu~o	736	.4893254	.2875361	.0012645	.9985868
leverage	736	5.016272	2.841948	.0075825	9.994436
leverage_g~h	736	-.1384123	2.87236	-4.992469	4.99097
share_lend~o	736	.4457462	.2855976	.0004328	.9967484
cash_total~s	736	.501396	.2857311	.0020538	.9958224
roe	736	.1524348	.5395984	-.9816115	.9990869
age	736	244.4252	144.9417	1.777644	499.0783
board_memb~s	736	4.849185	2.269064	0	12
liability_~e	736	.1358696	.342883	0	1

Figure 3: Descriptive statistics, non-distressed banks

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Linear regression                               Number of obs     =      1,000
                                                F(10, 989)        =     100.13
                                                Prob > F          =     0.0000
                                                R-squared         =     0.4397
                                                Root MSE          =     .33178
```

distress	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
liquid_liabilities_ratio	.4636842	.0363363	12.76	0.000	.392379	.5349893
foreign_funding_ratio	-.0058996	.0361423	-0.16	0.870	-.0768241	.0650249
leverage	-.0018808	.0036566	-0.51	0.607	-.0090564	.0052947
leverage_growth	.0080529	.0037141	2.17	0.030	.0007645	.0153413
share_lending_ratio	.5173922	.0353761	14.63	0.000	.4479714	.586813
cash_total_assets	.007759	.0370753	0.21	0.834	-.0649963	.0805143
roe	-.2705392	.0187979	-14.39	0.000	-.3074276	-.2336508
age	.0001122	.0000745	1.51	0.132	-.000034	.0002583
board_members	.0027485	.004724	0.58	0.561	-.0065218	.0120188
liability_structure	.3315954	.0290287	11.42	0.000	.2746306	.3885603
_cons	-.3199218	.0502461	-6.37	0.000	-.418523	-.2213206

Figure 4: Linear probability model

```
Iteration 0:  Log likelihood = -577.19935
Iteration 1:  Log likelihood = -327.71528
Iteration 2:  Log likelihood = -283.01785
Iteration 3:  Log likelihood = -280.61136
Iteration 4:  Log likelihood =  -280.6073
Iteration 5:  Log likelihood =  -280.6073

Logistic regression                                     Number of obs =  1,000
                                                        LR chi2(10)   = 593.18
                                                        Prob > chi2   = 0.0000
Log likelihood = -280.6073                              Pseudo R2     = 0.5138
```

distress	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
liquid_liabilities_ratio	5.304715	.48977	10.83	0.000	4.344784	6.264647
foreign_funding_ratio	-.1780124	.3758227	-0.47	0.636	-.9146113	.5585866
leverage	-.0384675	.0384473	-1.00	0.317	-.1138229	.0368879
leverage_growth	.0617518	.0375225	1.65	0.100	-.011791	.1352947
share_lending_ratio	5.963954	.516017	11.56	0.000	4.95258	6.975329
cash_total_assets	.0130904	.3711076	0.04	0.972	-.7142671	.740448
roe	-2.937414	.249186	-11.79	0.000	-3.42581	-2.449019
age	.0005622	.0007305	0.77	0.442	-.0008695	.001994
board_members	.0123705	.0471486	0.26	0.793	-.0800391	.1047802
liability_structure	3.196968	.2935141	10.89	0.000	2.621691	3.772245
_cons	-8.443744	.7069008	-11.94	0.000	-9.829245	-7.058244

Figure 5: Logit results

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Iteration 0:  Log likelihood = -577.19935
Iteration 1:  Log likelihood = -298.13124
Iteration 2:  Log likelihood =  -277.3716
Iteration 3:  Log likelihood =   -276.957
Iteration 4:  Log likelihood = -276.95581
Iteration 5:  Log likelihood = -276.95581

Probit regression                                       Number of obs =  1,000
                                                        LR chi2(10)   = 600.49
                                                        Prob > chi2   = 0.0000
Log likelihood = -276.95581                             Pseudo R2     = 0.5202
```

distress	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
liquid_liabilities_ratio	3.109277	.2746345	11.32	0.000	2.571003	3.647551
foreign_funding_ratio	-.1087372	.2149665	-0.51	0.613	-.5300638	.3125895
leverage	-.0213103	.0217405	-0.98	0.327	-.0639209	.0213002
leverage_growth	.0331799	.0211694	1.57	0.117	-.0083114	.0746711
share_lending_ratio	3.446121	.2829075	12.18	0.000	2.891632	4.000609
cash_total_assets	-.0079866	.2105076	-0.04	0.970	-.420574	.4046008
roe	-1.719117	.1392511	-12.35	0.000	-1.992044	-1.44619
age	.0003539	.0004146	0.85	0.393	-.0004587	.0011665
board_members	.0059702	.0267639	0.22	0.823	-.0464861	.0584264
liability_structure	1.839766	.1606005	11.46	0.000	1.524995	2.154537
_cons	-4.896238	.3896789	-12.56	0.000	-5.659994	-4.132481

Figure 6: Probit results

```
Average partial effects after logit
      y  = Pr(distress)
```

variable	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
liquid_liabilities_ratio	.4638207	.0305511	15.18	0.000	.4039416	.5236997
foreign_funding_ratio	-.0155646	.0328603	-0.47	0.636	-.0799696	.0488404
leverage	-.0033634	.0033555	-1.00	0.316	-.0099401	.0032133
leverage_growth	.0053993	.0032577	1.66	0.097	-.0009857	.0117843
share_lending_ratio	.5214615	.0301454	17.30	0.000	.4623776	.5805455
cash_total_assets	.0011449	.0324478	0.04	0.972	-.0624516	.0647414
roe	-.2568344	.0139106	-18.46	0.000	-.2840987	-.2295701
age	.0000492	.0000638	0.77	0.441	-.0000759	.0001742
board_members	.0010816	.0041216	0.26	0.793	-.0069966	.0091598
liability_structure	.3307244	.0278029	11.90	0.000	.2762317	.3852172

Figure 7: Average marginal effects, logit model

Average partial effects after **probit**
y = **Pr(distress)**

variable	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
liquid_liabilities_ratio	.4712867	.0300856	15.66	0.000	.4123201	.5302533
foreign_funding_ratio	-.0164818	.032571	-0.51	0.613	-.0803198	.0473563
leverage	-.0032301	.0032907	-0.98	0.326	-.0096798	.0032196
leverage_growth	.0050292	.0031966	1.57	0.116	-.0012359	.0112944
share_lending_ratio	.5223432	.0294099	17.76	0.000	.4647008	.5799856
cash_total_assets	-.0012107	.031907	-0.04	0.970	-.0637473	.0613259
roe	-.2605741	.0138531	-18.81	0.000	-.2877257	-.2334226
age	.0000536	.0000627	0.86	0.393	-.0000693	.0001766
board_members	.0009049	.0040565	0.22	0.823	-.0070457	.0088555
liability_structure	.3293626	.0271918	12.11	0.000	.2760675	.3826576

Figure 8: Average marginal effects, probit model

Variable	Obs	Mean	Std. dev.	Min	Max
distress	1,000	.264	.4410198	0	1
prob_ols	1,000	.264	.2924463	-.5649467	1.10536
prob_logit	1,000	.264	.327071	.0000126	.9987233
prob_probit	1,000	.2636531	.3284435	2.99e-11	.9999482

Figure 9: Predicted probabilities and in-sample frequency